# Test Report

| | |
|---|---|
| **Applicant：** | Apogee Inc. |
| **Address of Applicant：** | 1405 Pioneer Street Brea, CA 92821-1405 United States |
| **Equipment Under Test：** | Kanex Mini Multi-Sync Bluetooth Keyboard |
| **Model Number：** | K166-1036 |
| **Series：** | BT-7100, K166-1036-FR, K166-1036-GR, K166-1036-SP, K166-1036-SW, K166-1036-P1, K166-1036-P2 |

**Matrix Test Laboratory**
**2F, No.146, Jian Yi Rd., Chung-Ho District,**
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# Contents

# Test Result Certification

| | | |
|---|---|---|
| **Applicant** | : | Apogee Inc. |
| **Address of Applicant** | : | 1405 Pioneer Street Brea, CA 92821-1405 United States |
| **Manufacturer** | : | Lexking Technology Co., Ltd. |
| **Address of Manufacturer** | : | 7F-5 No.155, Zhongyang Road, Xindian Dist. New Taipei City, Taiwan 23150(R.O.C) |
| **Trade Name** | : | Kanex / LEXKING |
| **Equipment Under Test** | : | Kanex Mini Multi-Sync Bluetooth Keyboard |
| **Model Number** | : | K166-1036 |
| **Product Series** | : | BT-7100, K166-1036-FR, K166-1036-GR, K166-1036-SP, K166-1036-SW, K166-1036-P1, K166-1036-P2 |
| **FCC ID** | : | PYWK1661036 |
| **Filing Type** | : | Certification |
| **Sample Received Date** | : | 03-Dec-2015 |
| **Test Standard** | : | |

☒ FCC Part 15 Subpart C §15.249

**Deviations from standard test methods & any other specifications : NONE**

**Remark:**

1. This report details the results of the test carried out on one sample.
2. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in both ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.203, 15.207, 15.209, 15.249.
3. This report applies to the above sample only and shall not be reproduced in part without written approval of Matrix Test Laboratory
4. Test Location: HongAn Technology Co., Ltd., No.15-1 Cweishuh Keng, Cweipin Village, Linkou Dist., New Taipei City, Taiwan, R.O.C. FCC Designation No.: TW1071.

**Documented by:** Kay Wang 2015-12-22

**Kay Wang/ ADM. Dept Staff**

**Tested by:** Eason Hsieh 2015-12-04

**Eason Hsieh / ENG. Dept. Staff**

**Approved by:** Peter Chin **Date:** 2015-12-22

**Peter Chin / Section Manager**

# Summary of Test Result

| | Test Item | Applicable Standard | Test Result |
|---|---|---|---|
| 1 | Antenna Requirement | FCC part 15 subpart C §203 | Compliance |
| 2 | Conducted Emission | FCC part 15 subpart C §207 | N/A |
| 3 | Restricted Band of Operation | FCC part 15 subpart C §205 | Compliance |
| 4 | Radiated Emission | FCC part 15 subpart C §209 | Compliance |
| 5 | Field Strength | FCC part 15 subpart C §249(a) | Compliance |
| 6 | Out of Band Emission | FCC part 15 subpart C §249(d) | Compliance |
| 7 | 20dB Bandwidth | FCC part 15 subpart C §215(c) | Compliance |

# 1 General Description

## 1.1 Description of EUT

| | | |
|---|---|---|
| **Equipment Under Test** | **:** | Kanex Mini Multi-Sync Bluetooth Keyboard |
| **Model Number of EUT** | **:** | K166-1036 |
| **Product Series** | **:** | BT-7100, K166-1036-FR, K166-1036-GR, K166-1036-SP, K166-1036-SW, K166-1036-P1, K166-1036-P2 |
| **Power Supply** | **:** | Lithium Battery<br>DC 3.7 V |
| **Frequency Range** | **:** | 2402~2480 MHz |
| **Number of Channels** | **:** | 79 Channels |
| **Carrier Frequency of Each Channel** | **:** | See table below |
| **Antenna Specification** | **:** | PCB Antenna/ Gain: 3 dBi* |
| **Modulation Technique** | **:** | Bluetooth 3.0<br>FHSS<br>Bluetooth : GFSK |
| **Transmit Data Rate** | **:** | Bluetooth : 1Mbps |
| **Specification** | **:** | **Dimensions :** 28 cm (L) X 11 cm (W) X 1.3 cm (H)<br>**Weight :** 180 g |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 00 | 2402 | 20 | 2422 | 40 | 2442 | 60 | 2462 |
| 01 | 2403 | 21 | 2423 | 41 | 2443 | 61 | 2463 |
| 02 | 2404 | 22 | 2424 | 42 | 2444 | 62 | 2464 |
| 03 | 2405 | 23 | 2425 | 43 | 2445 | 63 | 2465 |
| 04 | 2406 | 24 | 2426 | 44 | 2446 | 64 | 2466 |
| 05 | 2407 | 25 | 2427 | 45 | 2447 | 65 | 2467 |
| 06 | 2408 | 26 | 2428 | 46 | 2448 | 66 | 2468 |
| 07 | 2409 | 27 | 2429 | 47 | 2449 | 67 | 2469 |
| 08 | 2410 | 28 | 2430 | 48 | 2450 | 68 | 2470 |
| 09 | 2411 | 29 | 2431 | 49 | 2451 | 69 | 2471 |
| 10 | 2412 | 30 | 2432 | 50 | 2452 | 70 | 2472 |
| 11 | 2413 | 31 | 2433 | 51 | 2453 | 71 | 2473 |
| 12 | 2414 | 32 | 2434 | 52 | 2454 | 72 | 2474 |
| 13 | 2415 | 33 | 2435 | 53 | 2455 | 73 | 2475 |
| 14 | 2416 | 34 | 2436 | 54 | 2456 | 74 | 2476 |
| 15 | 2417 | 35 | 2437 | 55 | 2457 | 75 | 2477 |
| 16 | 2418 | 36 | 2438 | 56 | 2458 | 76 | 2478 |
| 17 | 2419 | 37 | 2439 | 57 | 2459 | 77 | 2479 |
| 18 | 2420 | 38 | 2440 | 58 | 2460 | 78 | 2480 |
| 19 | 2421 | 39 | 2441 | 59 | 2461 | - | - |

| | | |
|---|---|---|
| | | **Intended Function :** The EUT is a Kanex Mini Multi-Sync Bluetooth Keyboard.<br>**Product Variance :** The manufacturer declares that the series products are identical to the main test sample. For marketing reason and different language versions, there are different series numbers. Matrix only takes the responsibility to the test result of the main test sample. |

## 1.2 Test Instruments

| Instrument Name | Manufacturer Mode | Model Number | Serial Number | Last Cal. Date | Next Cal. Date | Instrument Uncertainty |
|---|---|---|---|---|---|---|
| RF Amplifier | Schaffner | CPA9231A | 0405 | 01-JUN-2015 | 31-MAY-2016 | 2.13dB |
| EMI Receiver | R&S | ESCI | 100931 | 25-JUL-2015 | 24-JUL-2016 | 0.87dB |
| Spectrum Analyzer | R&S | FSV | 101629 | 27-JAN-2015 | 26-JAN-2016 | 0.64dB |
| Preamplifier | HD | HD17187 | 004 | 01-JUN-2015 | 31-MAY-2016 | 0.34dB |
| Bilog Antenna | TESEQ | CBL6111D | 38521 | 04-JUN-2015 | 03-JUN-2016 | 1.0dB |
| Double-Ridged Waveguide Horn | EMCO | 3115 | 9912-5992 | 01-JUN-2015 | 31-MAY-2016 | 0.9dB |
| Horn Antenna (18-40GHz) | Com -Power | AH-840 | 101042 | 02-JUN-2015 | 01-JUN-2016 | 2.0dB |
| Microwave Preamplifier | Com -Power | PAM-840 | 461269 | 04-JUN-2015 | 03-JUN-2016 | 0.50dB |
| LOOP Antenna | EMCO | 6512 | 00035867 | 01-OCT-2015 | 30-SEP-2016 | 0.8dB |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 13054416-001 | 07-OCT-2015 | 06-OCT-2016 | 0.64dB |
| Temperature Chamber | MALLIER | MCT-2X-M | 13490413-001 | 15-DEC-2015 | 14-DEC-2016 | 0.2$^{o}$C |

※ The test equipments used are calibrated and can be traced to National ITRI and International Standards.

## 1.3 Auxiliary Equipments

1.3.1. Provided by Matrix Test Laboratory for Emission Test.

N/A

1.3.2. Provided by the Manufacturer

N/A

## 1.4 EUT SETUP


Note: Main Test Sample: K166-1036

## 1.5 Identifying the Final Test Mode

1. Mode 1: TX BT mode (1Mbps) CH 00.
2. Mode 2: TX BT mode (1Mbps) CH 39.
3. Mode 3: TX BT mode (1Mbps) CH 78.

Note:

1. After pre-test, we identified that the TX (Packet type DH5 and X axis) was most likely to cause maximum disturbance and most likely to be susceptible to disturbance. Therefore, the Final Assessment was performed for the worst case.
2. The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.
3. Channel Low (2402 MHz), Mid (2441 MHz) and High (2480 MHz) were chosen for full testing.
4. According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

## 1.6 Final Test Mode

Conducted Emission: N/A.

Field Strength: All Mode.

Radiated Emission (30~1000 MHz): Mode 1.

Radiated Emission (1~26.5GHz): All Mode.

## 1.7 Condition of Power Supply

DC 3.7 V, Lithium battery.

## 1.8 EUT Configuration

1. Setup the EUT as shown in Sec.1.4 Block Diagram.
2. Turn on the power of all equipments.
3. Activate the selected Final Test Mode.

## 1.9 Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10 (2013) and FCC CFR 47 15.203, 15.207, 15.209 and 15.249.

## 1.10 General Test Procedures

**Conducted Emissions**

The EUT is set according to the requirements in Section 6.2 of ANSI C63.10 (2013).

**Radiated Emissions**

The EUT is set according to the requirements in Section 6.3 of ANSI C63.10 (2013).

## 1.11 Modification

N/A

## 1.12 FCC Part 15.205 restricted bands of operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37635-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | ([2]) |
| 13.36-13.41 | | | |

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

## 1.13 Qualification of Test Facility

| | | |
|---|---|---|
| **Name of Test Facility** | **:** | HongAn Technology |
| **Address of Test Facility** | **:** | No. 15-1, Cweishuh Keng, Cweipin Village, Linkou, New Taipei City, Taiwan, R.O.C |
| **FCC Designation No.** | **:** | TW1071 |
| **TAF Accreditation No.** | **:** | 1163 |

# 2 Power line Conducted Emission Measurement

## 2.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

## 2.2 Test Arrangement and Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

## 2.3 Limit (§ 15.207)

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

| Frequency (MHz) | Limits (dBuV) | |
|---|---|---|
| | Q.P. (Quasi-Peak) | A.V. (Average) |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5.0 | 56 | 46 |
| 5.0 to 30 | 60 | 50 |

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

## 2.4 Test Result

**N/A**

The Device uses a Lithium battery as its power source. Further more, when charging the device's battery through USB connection, the device can not be operated.

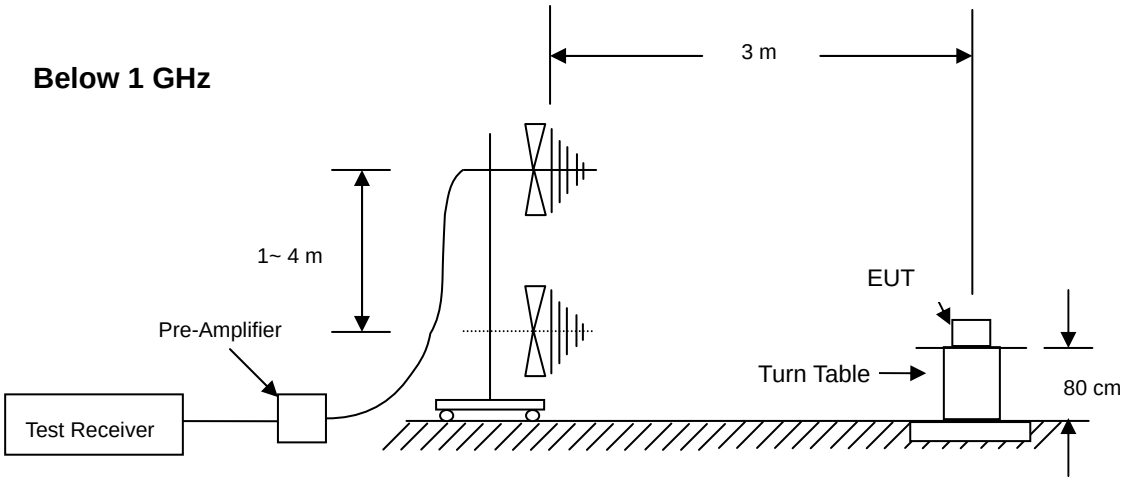
# 3 Radiated Emission Test

## 3.1 Test Instruments

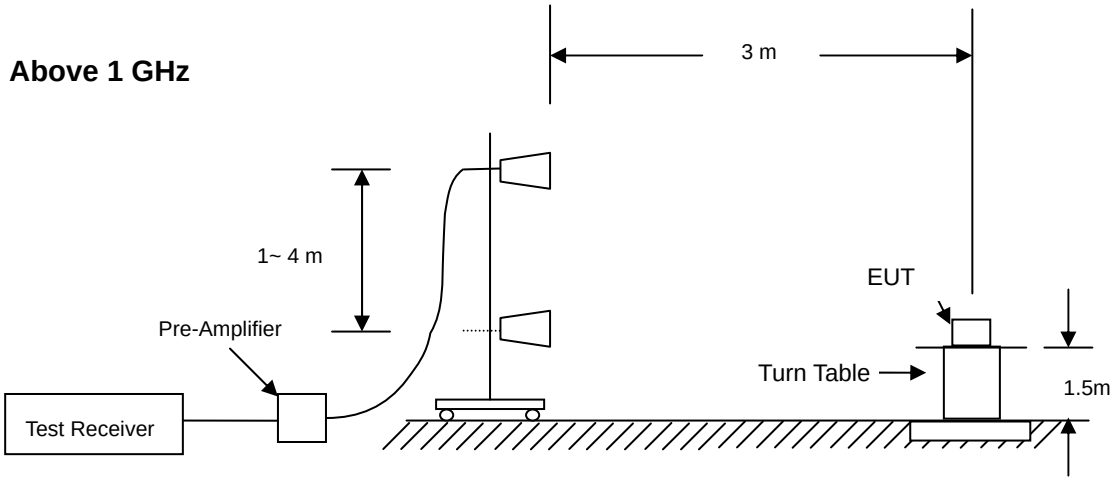
Refer to Sec. 1.2 Test Instruments.

## 3.2 Test Arrangement and Procedure

**Below 1 GHz**




**Above 1 GHz**




1. The EUT is placed on a turntable, which is 0.8 m (below 1GHz) and 1.5m (above 1GHz) above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1 m to 4 m to find out the highest emissions.
4. Maxium procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer. Refer to each test results for detail setting up.
7. Repeat above procedures until the meausreemnts for all frequencies are complete.

## 3.3 Limit of Field Strength of Fundamental (§ 15.249)

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency (MHz) | Field strength of fundamental (microvolts/ meter) | Field strength of harmonics (meters) |
|---|---|---|
| 902-928 | 50 | 500 |
| 2400-2483.5 | 50 | 500 |
| 5725-5875 | 50 | 500 |
| 24000-24250 | 250 | 2500 |

Note:

1. Field strength limits are specified at a distance of 3 meters.
2. For frequencies above 1000 MHz, the field strength limits in above table are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 3.4 Limit of Spurious Emission (§ 15.209)

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is lesser attenuation.

| Frequency (MHz) | Field strength (microvolts/ meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100** | 3 |
| 88-216 | 150** | 3 |
| 216-960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g.§§ 15.231 and 15.241.

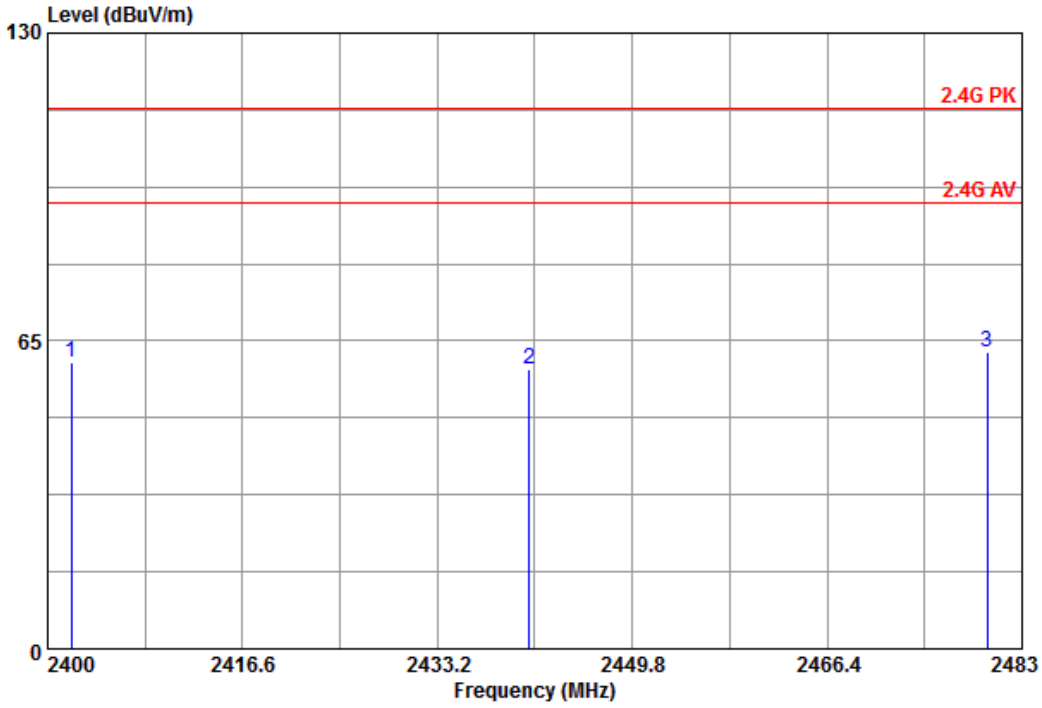
## 3.5 Test Result

**Compliance**

The final test data are shown on the following page(s).

## Radiated Emission Test Data (Field Strength of Fundamental)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH00, 39, 78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | 2402.000 | 68.09 | -7.63 | 60.46 | 94.00 | -33.54 | --- | --- | Peak |
| 2 | 2441.000 | 66.56 | -7.49 | 59.07 | 94.00 | -34.93 | --- | --- | Peak |
| 3 | @2480.000 | 70.00 | -7.39 | 62.61 | 94.00 | -31.39 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

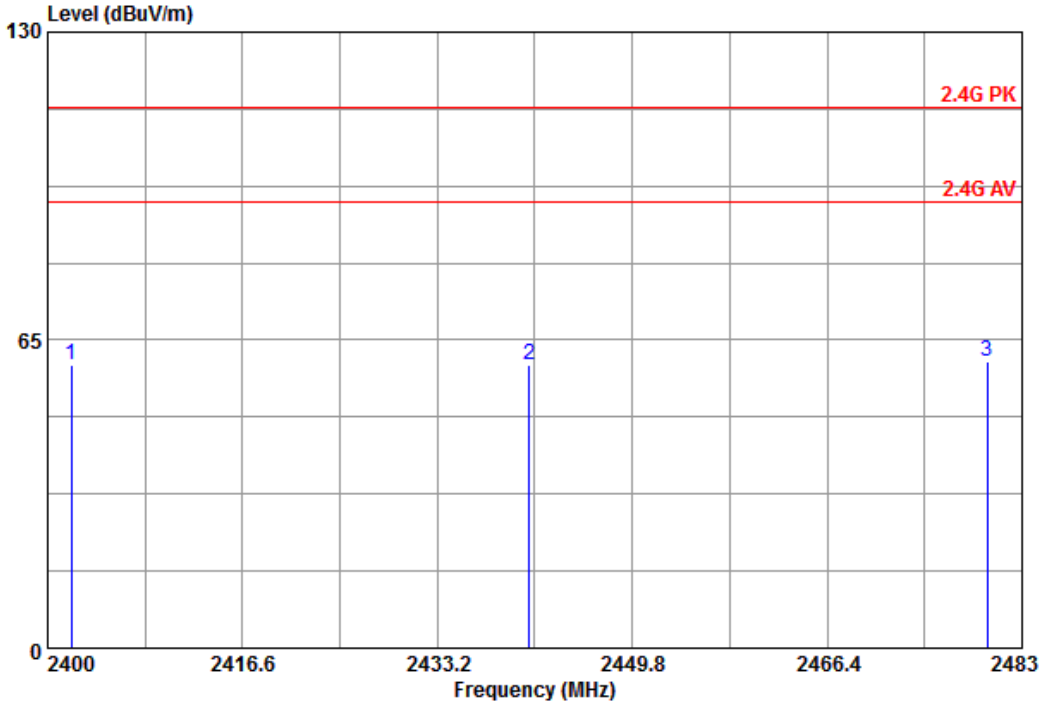
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 3MHz, VBW =10MHz, Sweep = AUTO.
   Note: Because the 20 dB Bandwidth is over 1MHz, the RBW setting of measuring Field strength of Fundamental should be 3MHz, and VBW should be at 10 MHz.

## Radiated Emission Test Data (Field Strength of Fundamental)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH00, 39, 78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | 2402.000 | 67.46 | -7.63 | 59.83 | 94.00 | -34.17 | --- | --- | Peak |
| 2 | 2441.000 | 67.28 | -7.49 | 59.79 | 94.00 | -34.21 | --- | --- | Peak |
| 3 | @2480.000 | 67.70 | -7.39 | 60.31 | 94.00 | -33.69 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

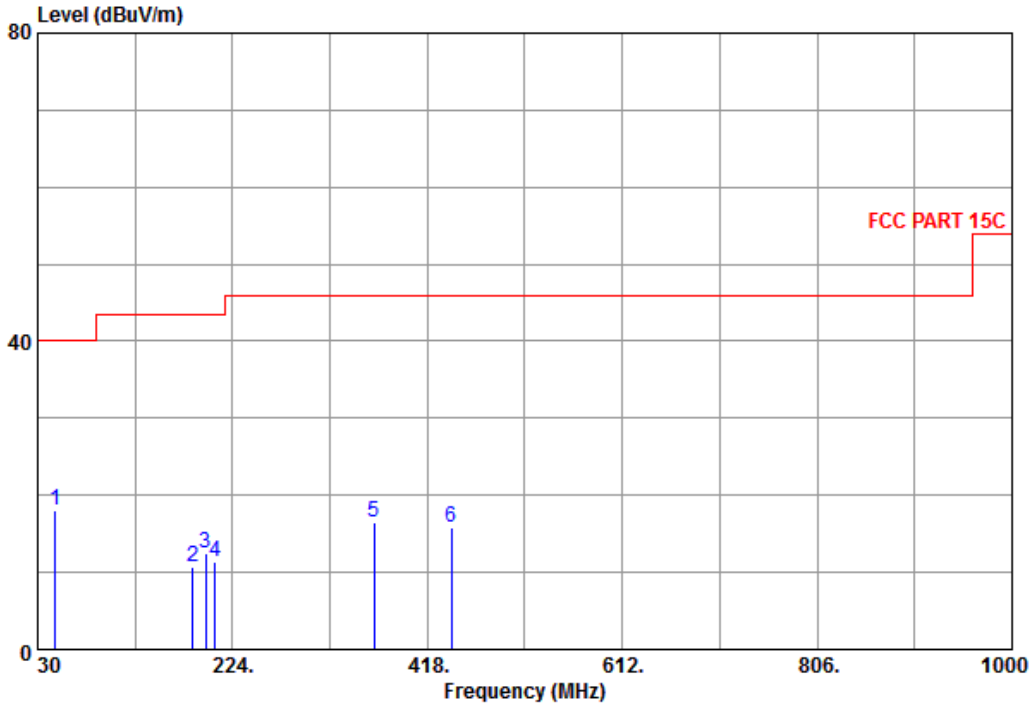
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   Peak Setting 1GHz to 10th harmonics of fundamental, RBW = 3MHz, VBW =10MHz, Sweep = AUTO.
   Note: Because the 20 dB Bandwidth is over 1MHz, the RBW setting of measuring Field strength of Fundamental should be 3MHz, and VBW should be at 10 MHz.

## Radiated Emission Test Data (Below 1 GHz)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 @ | 47.460 | 31.73 | -13.61 | 18.12 | 40.00 | -21.88 | --- | --- | Peak |
| 2 | 184.230 | 29.69 | -19.01 | 10.68 | 43.50 | -32.82 | --- | --- | Peak |
| 3 | 196.840 | 31.46 | -19.02 | 12.44 | 43.50 | -31.06 | --- | --- | Peak |
| 4 | 206.540 | 30.45 | -19.17 | 11.28 | 43.50 | -32.22 | --- | --- | Peak |
| 5 | 364.650 | 32.58 | -16.20 | 16.38 | 46.00 | -29.62 | --- | --- | Peak |
| 6 | 442.250 | 31.73 | -15.87 | 15.86 | 46.00 | -30.14 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

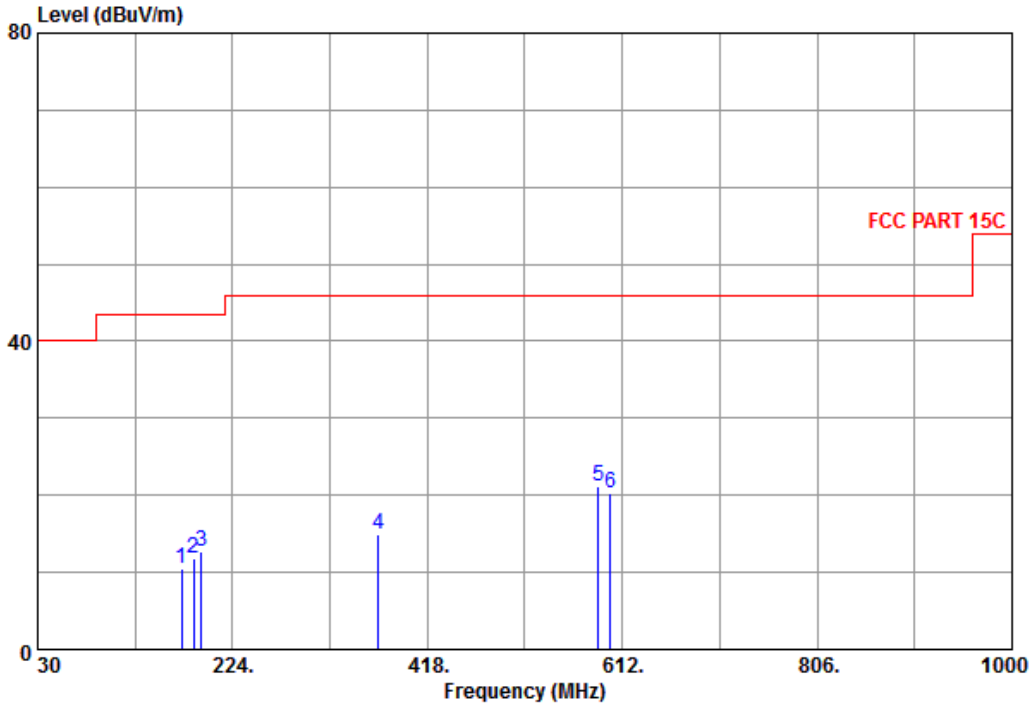
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 30 MHz to 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode.
3. Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
4. All readings are Peak values. None of the peak value reading exceeds the Q.P. limit. Hence, Q.P. reading was not measured.
5. The IF bandwidth of SPA between 30 MHz to 1 GHz was 100 kHz.

## Radiated Emission Test Data (Below 1 GHz)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | 173.560 | 32.59 | -22.08 | 10.51 | 43.50 | -32.99 | --- | --- | Peak |
| 2 | 185.200 | 30.91 | -19.01 | 11.90 | 43.50 | -31.60 | --- | --- | Peak |
| 3 | 192.960 | 31.80 | -19.03 | 12.77 | 43.50 | -30.73 | --- | --- | Peak |
| 4 | 369.500 | 30.96 | -16.06 | 14.90 | 46.00 | -31.10 | --- | --- | Peak |
| 5 @ | 587.750 | 32.61 | -11.40 | 21.21 | 46.00 | -24.79 | --- | --- | Peak |
| 6 | 600.360 | 31.22 | -10.91 | 20.31 | 46.00 | -25.69 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

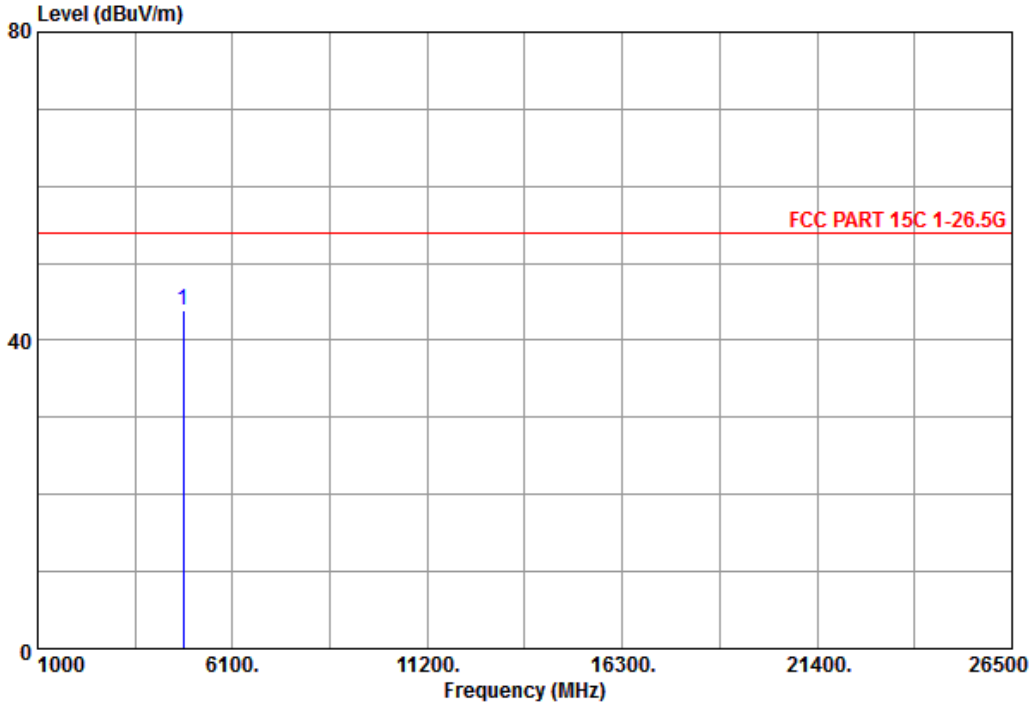
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 30 MHz to 1 GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000 MHz were made with an instrument using Peak detector mode.
3. Data of measurement within this frequency range shown “---” in the table above means the reading of emissions are attenuated more than 20 dB below the permissible limits or the field strength is too small to be measured.
4. All readings are Peak values. None of the peak value reading exceeds the Q.P. limit. Hence, Q.P. reading was not measured.
5. The IF bandwidth of SPA between 30 MHz to 1 GHz was 100 kHz.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 @ | 4804.000 | 43.30 | 0.49 | 43.79 | 54.00 | -10.21 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

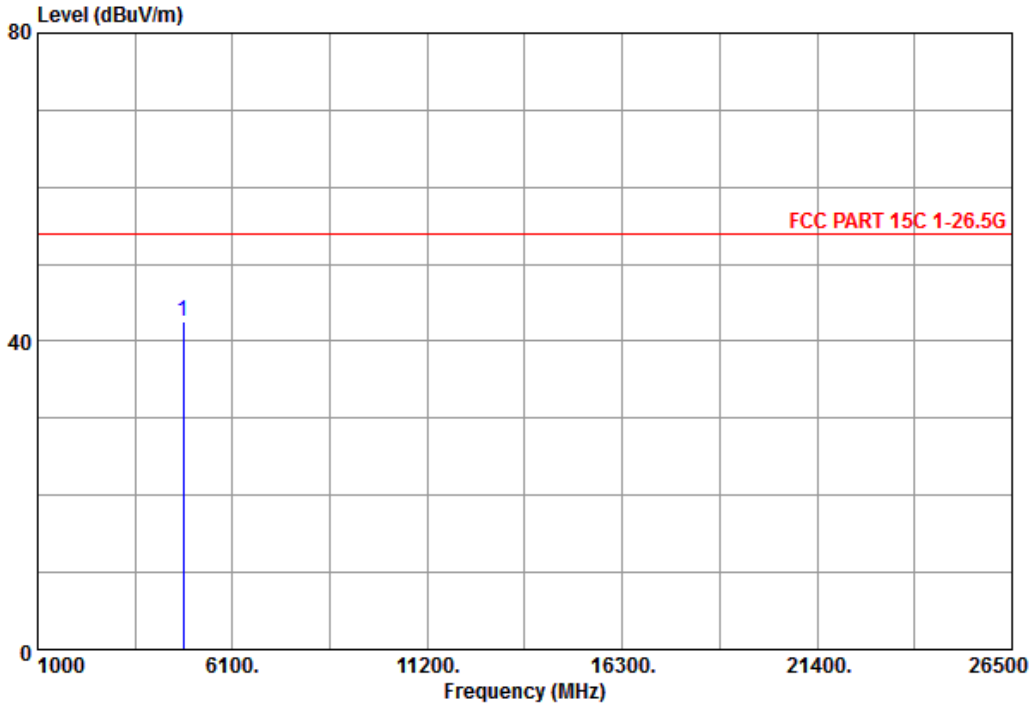
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @4804.000 | 42.09 | 0.49 | 42.58 | 54.00 | -11.42 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

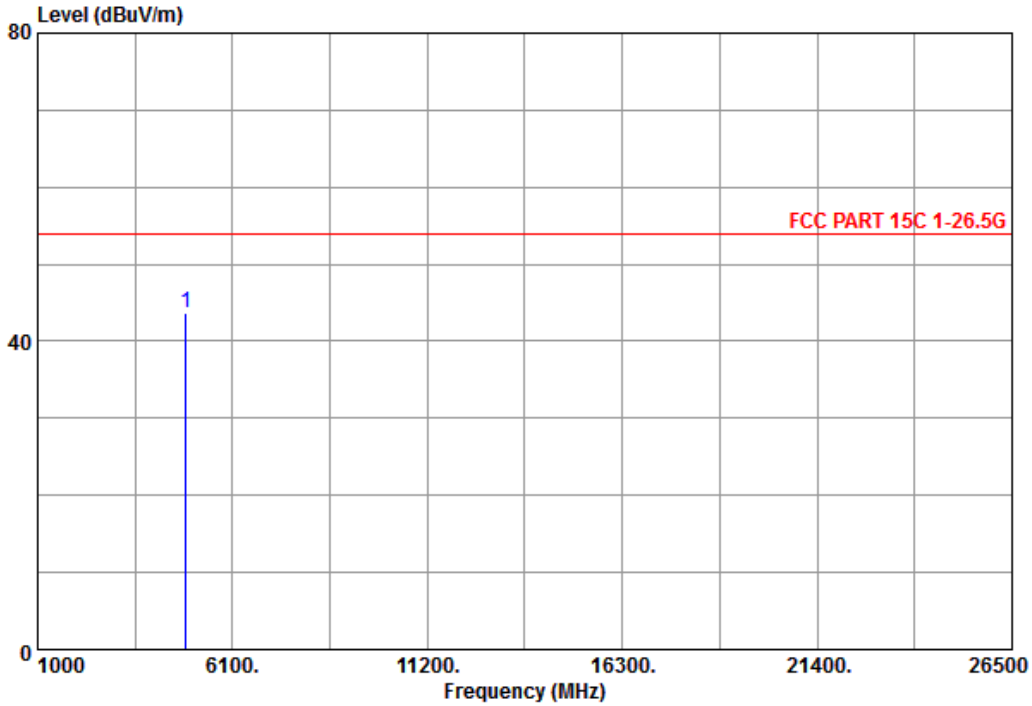
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH39 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @4882.000 | 42.98 | 0.80 | 43.78 | 54.00 | -10.22 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

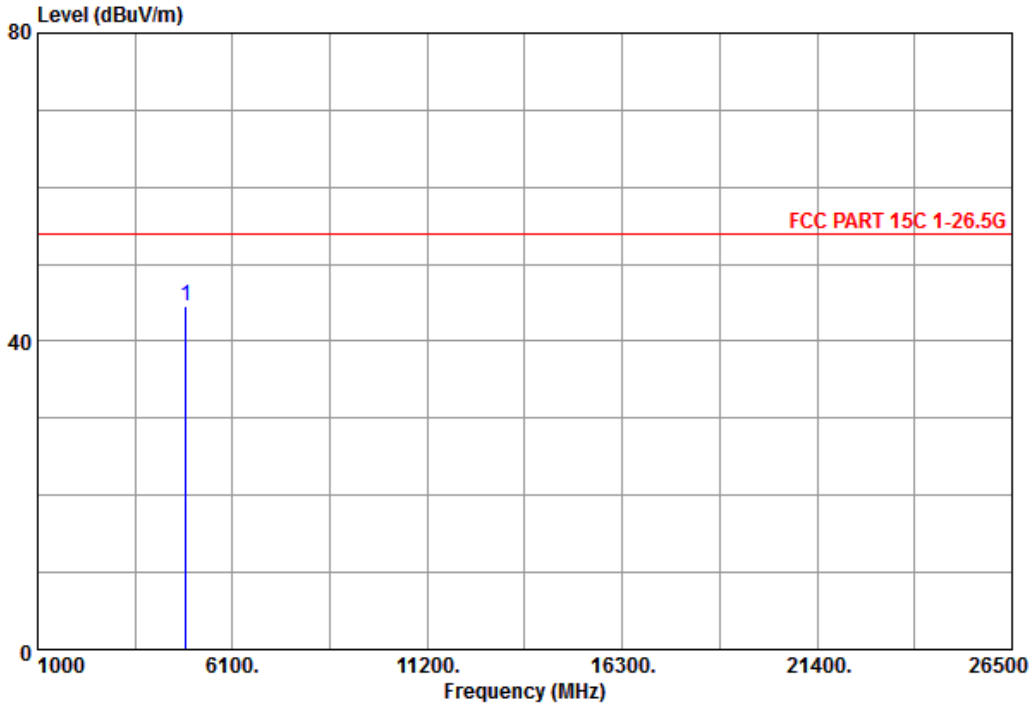
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH39 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @4882.000 | 43.70 | 0.80 | 44.50 | 54.00 | -9.50 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

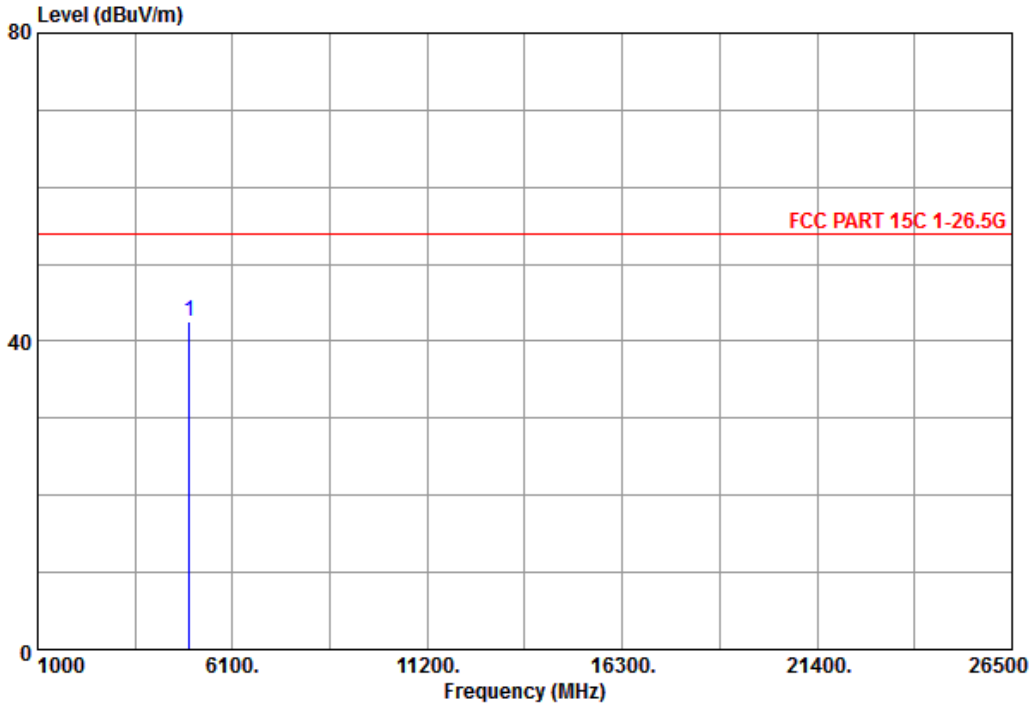
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @4960.000 | 41.30 | 1.15 | 42.45 | 54.00 | -11.55 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

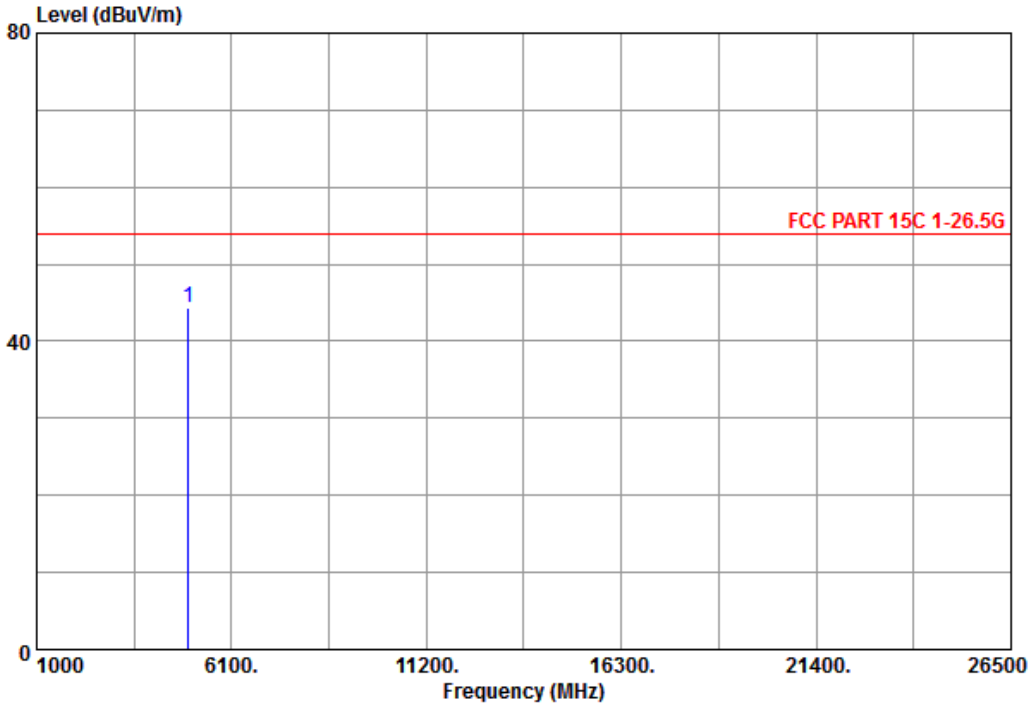
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   **(a)** Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   **(b)** Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

## Radiated Emission Test Data (Above and Field Strength to 10th Harmonic)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @4960.000 | 43.30 | 1.15 | 44.45 | 54.00 | -9.55 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO. Use Peak detector.

# 4 Out of Band Emission Test

## 4.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

## 4.2 Test Arrangement and Procedure

Refer to Sec. 3.2.

## 4.3 Limit of Field Strength of Fundamental (§ 15.249(d))

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.

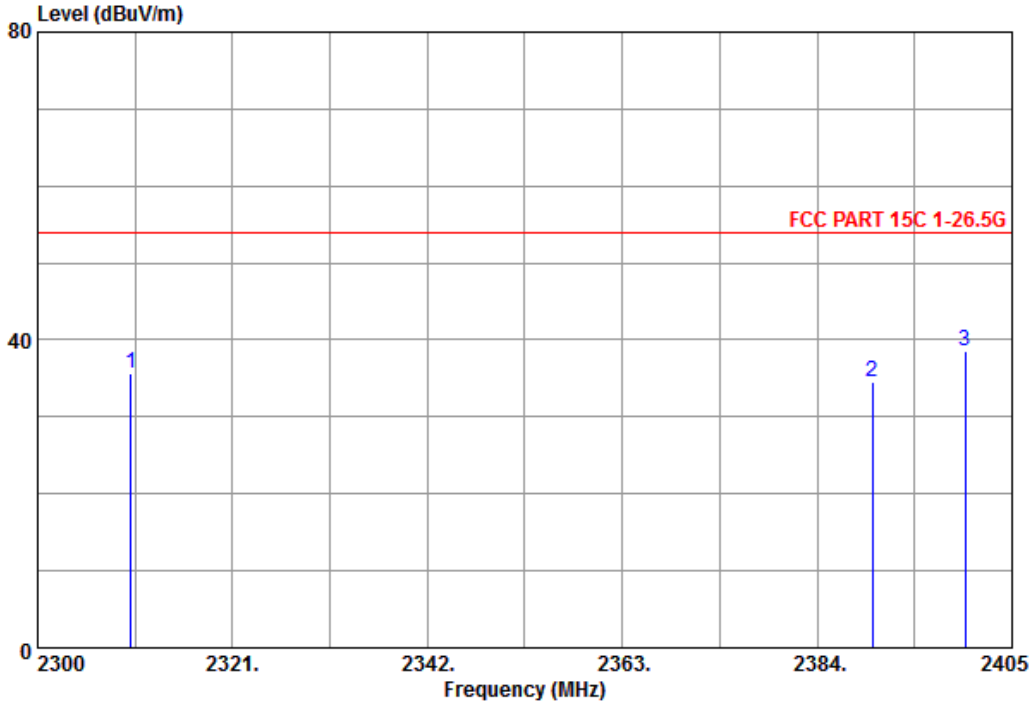
## 4.4 Test Result

**Compliance**

The final test data are shown on the following page(s).

## Band-Edge Test Data (Lower Edge)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | 2310.000 | 43.47 | -7.88 | 35.59 | 54.00 | -18.41 | --- | --- | Peak |
| 2 | 2390.000 | 42.24 | -7.63 | 34.61 | 54.00 | -19.39 | --- | --- | Peak |
| 3 | @2400.000 | 46.08 | -7.63 | 38.45 | 54.00 | -15.55 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

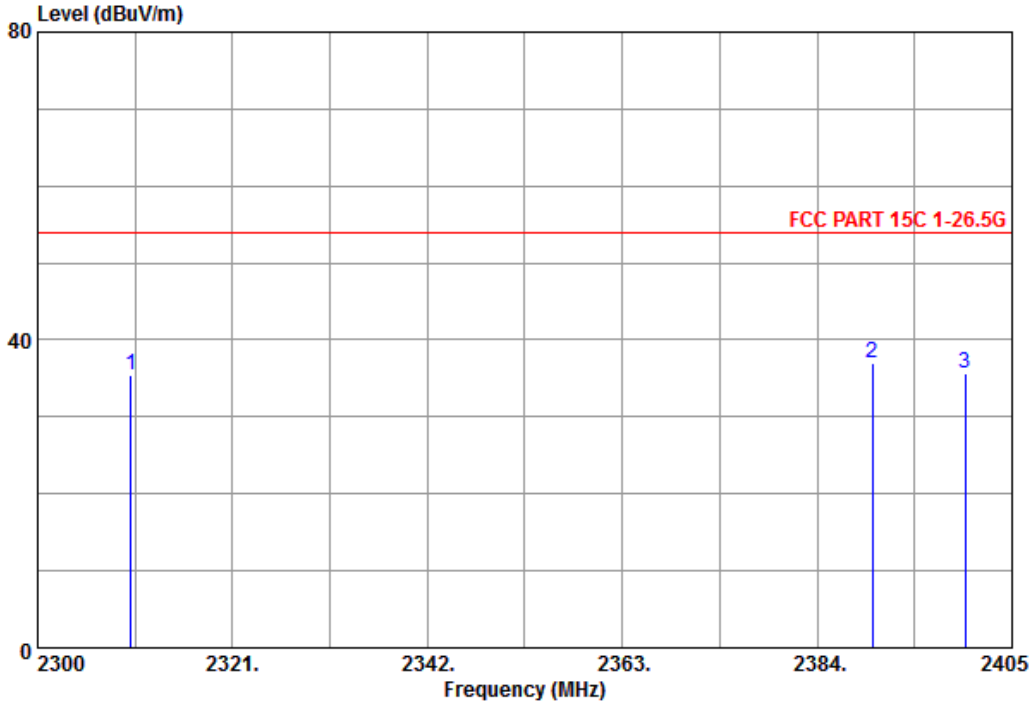
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO.

## Band-Edge Test Data (Lower Edge)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH00 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | 2310.000 | 43.35 | -7.88 | 35.47 | 54.00 | -18.53 | --- | --- | Peak |
| 2 | @2390.000 | 44.71 | -7.63 | 37.08 | 54.00 | -16.92 | --- | --- | Peak |
| 3 | 2400.000 | 43.36 | -7.63 | 35.73 | 54.00 | -18.27 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

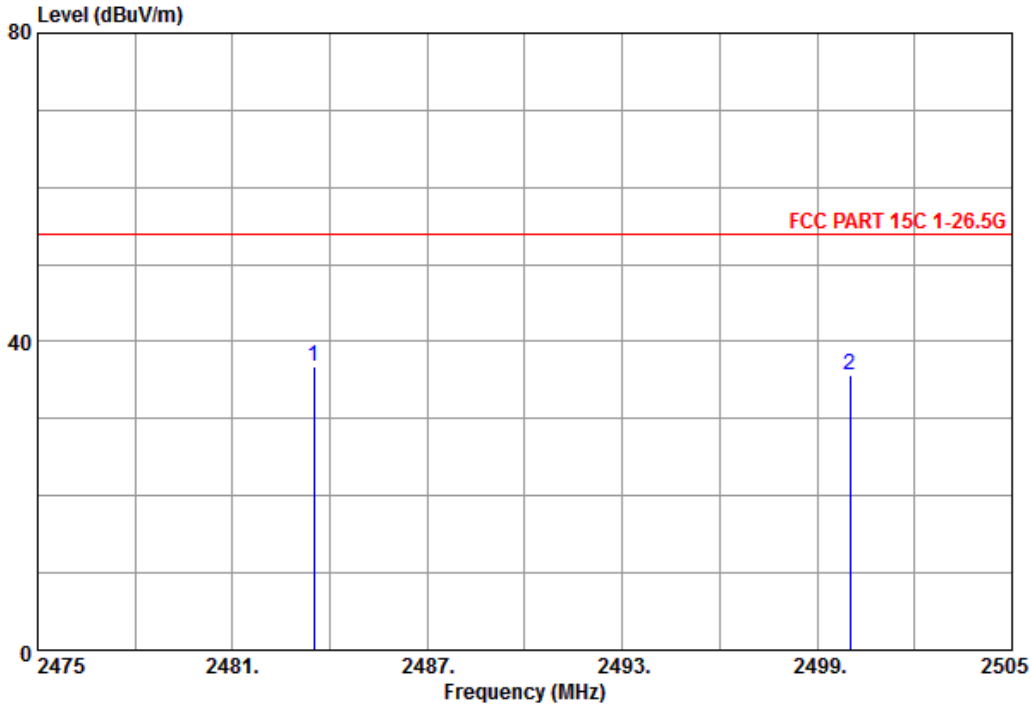
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO.

## Band-Edge Test Data (Upper Edge)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Vertical | Channel | : | CH78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @2483.500 | 44.14 | -7.39 | 36.75 | 54.00 | -17.25 | --- | --- | Peak |
| 2 | 2500.000 | 42.98 | -7.33 | 35.65 | 54.00 | -18.35 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

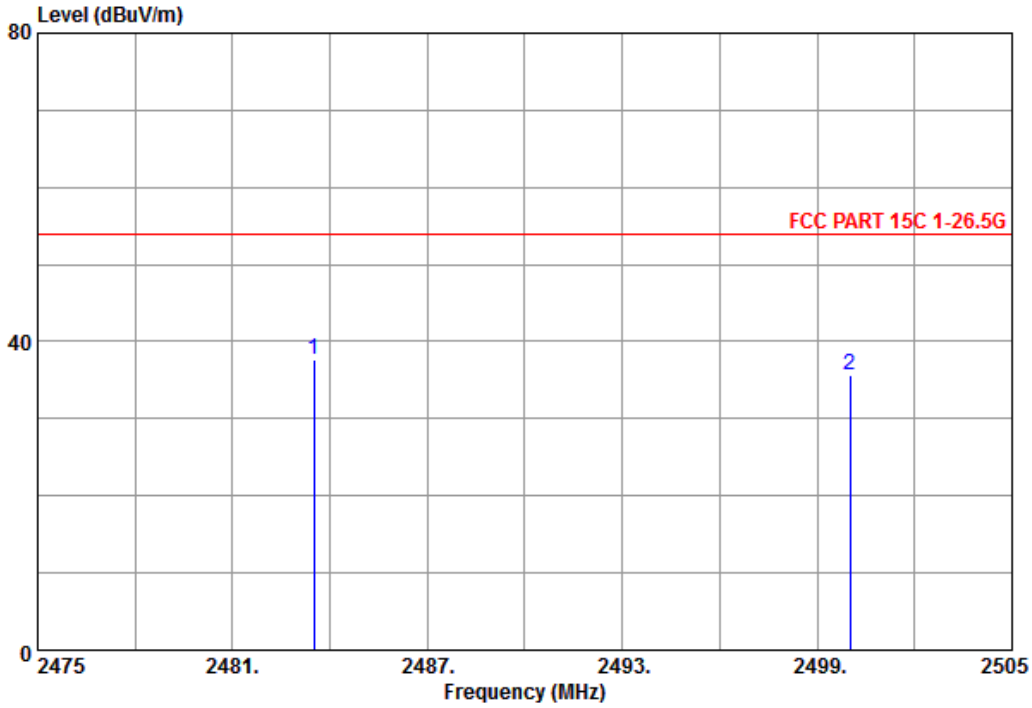
@ :Maximum Data x :Over Limit

Remark：

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO.

## Band-Edge Test Data (Upper Edge)

| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Polarization | : | Horizontal | Channel | : | CH78 |
| EUT Position | : | X axis | | | |




| | Freq | Reading | C.F | Result | Limit | Margin | A/pos | T/pos | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV/m | dBuV/m | dB | | | |
| 1 | @2483.500 | 45.05 | -7.39 | 37.66 | 54.00 | -16.34 | --- | --- | Peak |
| 2 | 2500.000 | 43.01 | -7.33 | 35.68 | 54.00 | -18.32 | --- | --- | Peak |

C.F = Antenna Factor + Cable Loss - Preamp gain
Result = Reading + C.F ; Margin = Result - Limit

@ :Maximum Data x :Over Limit

Remark：

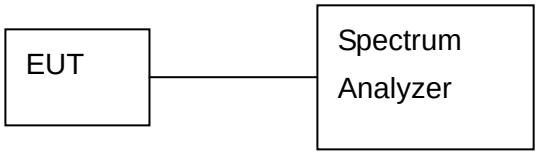
1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded (ie: margin > 20dB from the applicable limit) and considered that's already beyond the background noise floor.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. All readings are Peak values. None of the peak value reading exceeds the A.V. limit. Hence, A.V. reading was not measured.
5. Spectrum setting:
   (a) Peak Setting 1GHz to 10th harmonics of fundamental, RBW = VBW = 1MHz, Sweep = AUTO.
   (b) Average Setting 1GHz to 10th harmonics of fundamental,: RBW = 1MHz, VBW = 10Hz, Sweep = AUTO.

# 5 20 dB Bandwidth

## 5.1 Test Instruments

Refer to Sec. 1.2 Test Instruments.

## 5.2 Test Arrangement and Procedure




1. The transmitter output was connected to a spectrum analyzer (through an attenuator, if it's necessary).
2. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW. Measured the -20 dB bandwidth and plotted the graph.

## 5.3 Limit

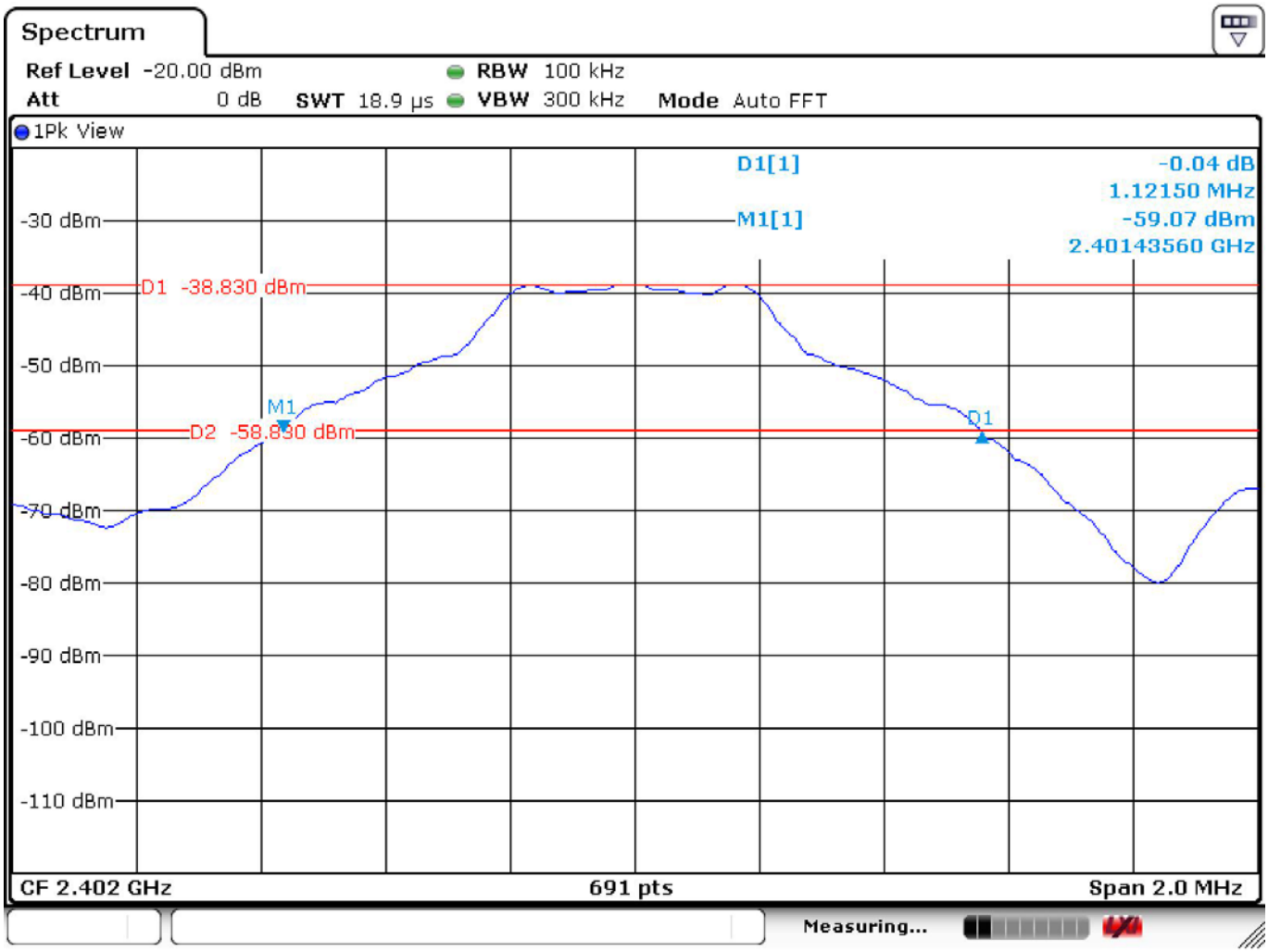
None; For report purpose only.

## 5.4 Test Result

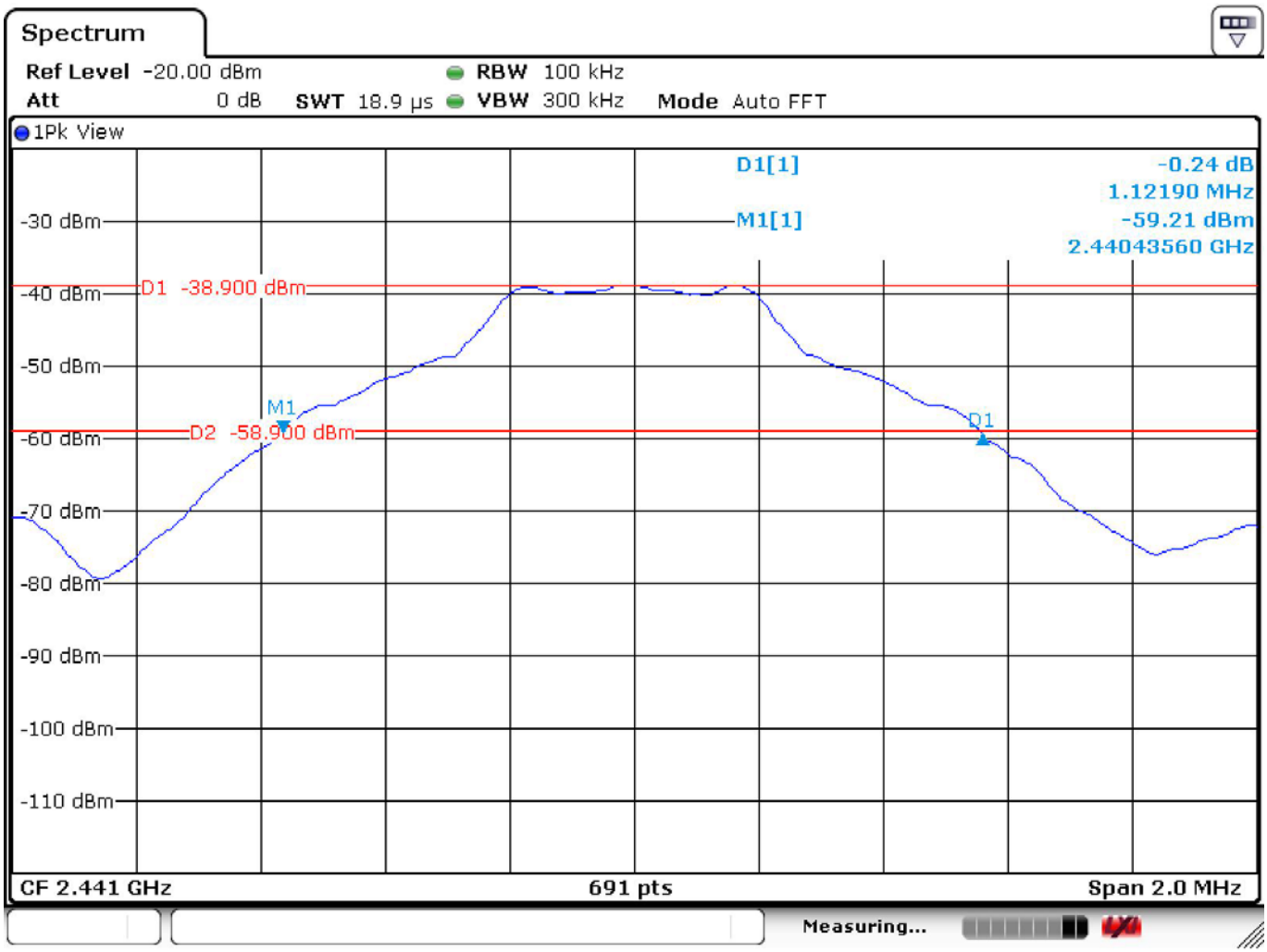
**No non-compliance noted.**

The final test data are shown on the following page(s).

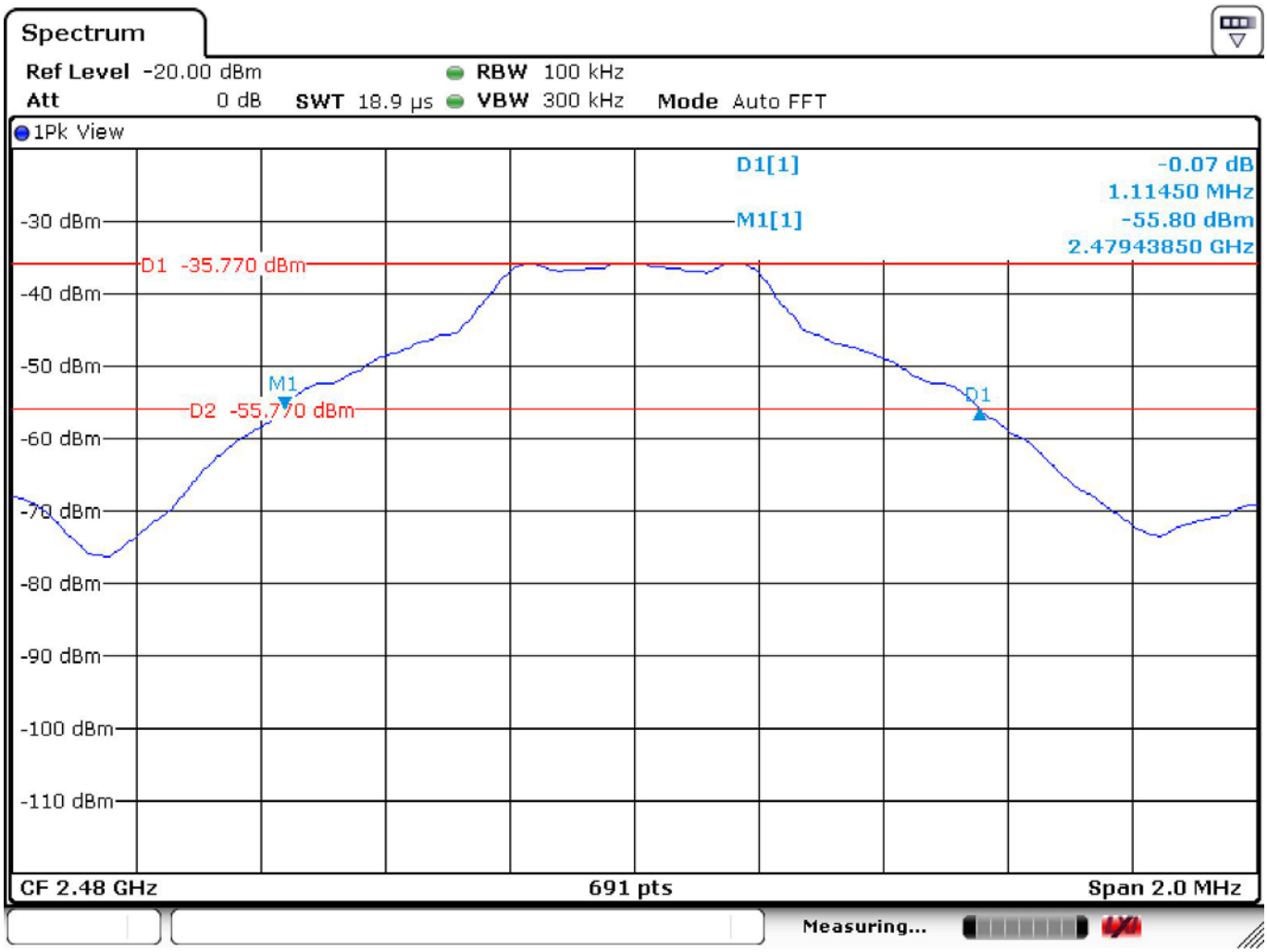
| | | | | | |
|---|---|---|---|---|---|
| Temperature | : | 24.4℃ | Humidity | : | 51% |
| Test Date | : | 04-Dec-2015 | Tested by | : | Eason Hsieh |
| Test Mode | : | BT (1 Mbps) DH5 | Channel | : | 00 |



Test Mode : BT (1 Mbps) DH5 Channel : 39



Test Mode : BT (1 Mbps) DH5 Channel : 78



# 6 Antenna requirement

## 6.1 Limit (§ 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

## 6.2 Test Result

**Compliance.**

The EUT applies a PCB antenna.

----------End Of Test Report----------

# 7 Photographs of the Tests

## 7.1 Radiated Disturbances Emission Test

Below 1 GHz

Above 1 GHz

# 8 Photographs of the EUT

Front View of the EUT


Rear View of the EUT

Side View of the EUT

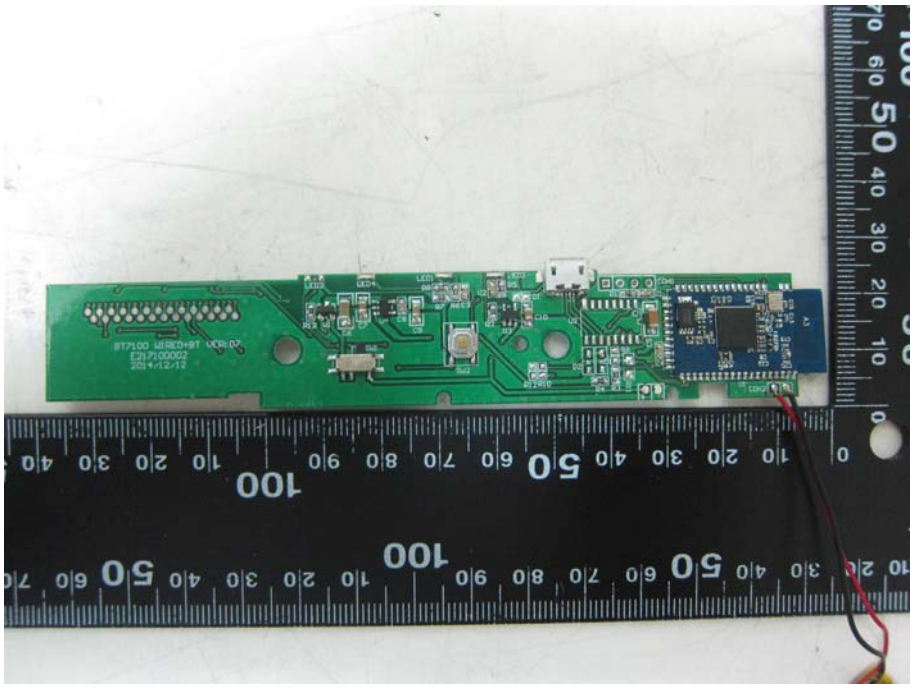
Side View of the EUT

Front View of the EUT

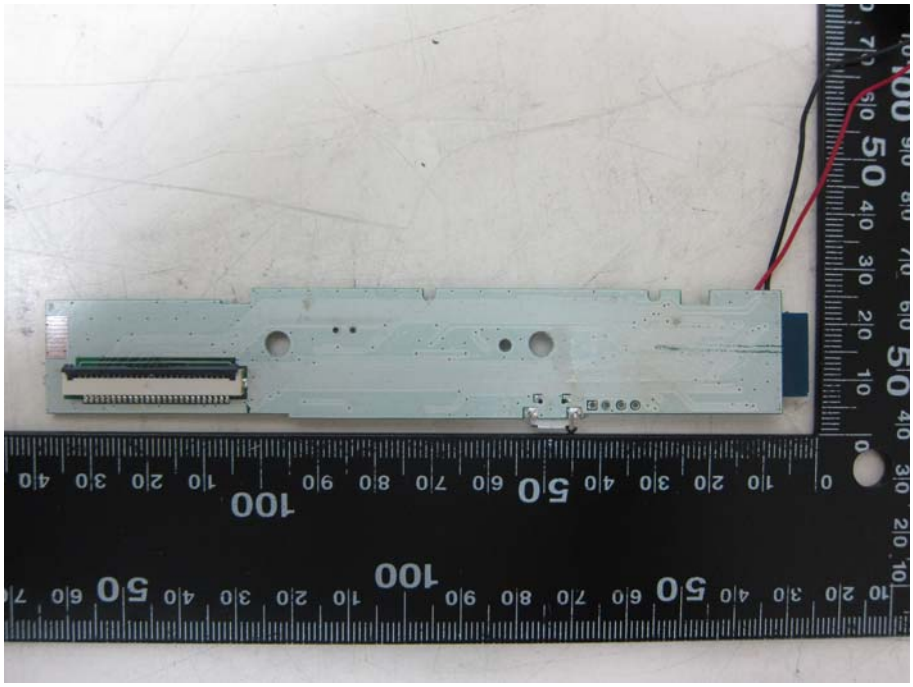
Rear View of the EUT

Closer View of the USB port

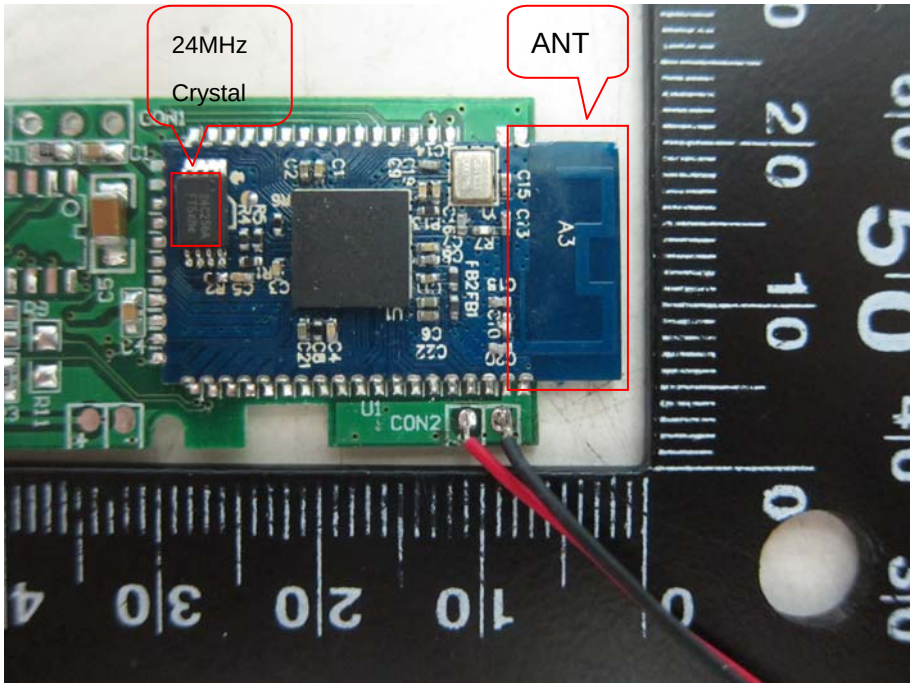
Inside View of the PCB



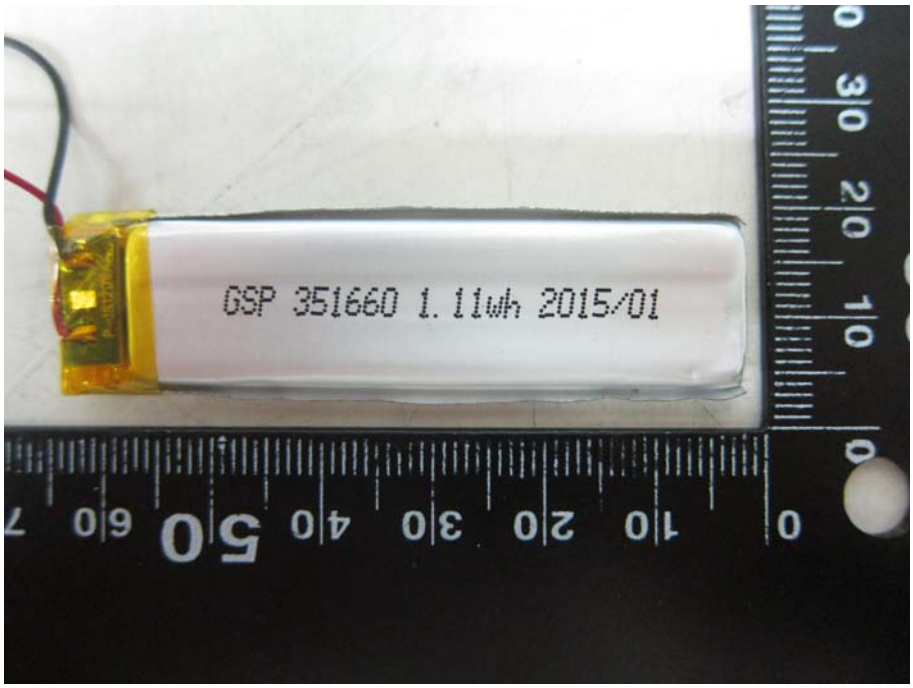
Front View of the PCB



Rear View of the PCB




Front View of the Bluetooth module




Front View of Battery

Rear View of Battery